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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

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A PRELIMINARY ANALYSIS OF PINE-BEETLE HAZARD CONDITIONS IN THE KLAMATH SUBREGION, OREGON

By
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Bureau of Entomology & Plant Quarantine

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Forest Insect Laboratory
445 U. S. Court House
Portland, Oregon
July 31, 1939

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The Beetle Hazard Problem.

One of the greatest hazards to mature and overmature ponderosa pine forests is the risk of serious beetle depredations. In eastern Oregon and Washington during the last two decades, the loss of ponderosa pine timber through beetle attack has been more than 16 times that lost through forest fires, averaging 828 million board feet per year. Commercial stands carrying a high percentage of mature and overmature pine have been especially hard hit, with net losses during a decade running from 10 to 60 percent of the volume of the stand.

One outstanding characteristic of these losses has been their uneven distribution. Within a few miles of areas showing heavy beetle damage stands may be found which are putting on net growth and show only minor losses even during critical climatic periods. Why these large differences, and can they be anticipated on the basis of certain recognizable local conditions?

To the owners and managers of large timber tracts the answer to this question would be particularly helpful, for it would make possible the sale or cutting of high-risk areas ahead of those relatively immune to beetle loss. It would make possible the planning of logging operations with the beetle risk factor in mind.

It would also assist foresters in determining what type of control action to take in order to protect a given forest from further beetle depredations, and how heavy a marking is desirable in different areas.

For the past several years the Division of Forest Insect Investigations of the Bureau of Entomology and Plant Quarantine has given special attention to the solving of the beetle-hazard problem. Work under way at both the Berkeley and Portland forest insect laboratories has already reached the point where preliminary answers can be given, and areas can be zoned as to beetle risk on the basis of recognizable conditions.

The present report gives the results of a preliminary analysis of bark-beetle hazard conditions in the Klamath Subregion of southeastern Oregon, and includes a hazard map which was prepared as a result of these studies. The methods employed are described in detail in a previous report by the writer entitled "An Approach to the Problem of Determining Pine-Beetle Hazard in Ponderosa Pine Forests of Oregon and Washington" dated July 29, 1939, but for the sake of clarity, these methods are briefly reviewed here.

Basis for Hazard Zone Map. The hazard map accompanying this report was prepared by combining and interpreting two sets of basic data compiled on two preliminary maps. The first of these was a map showing stand conditions and the second a map of actual beetle loss sustained during the past 10 to 20 years.

The stand condition map was prepared on a transparent overlay sheet, using the Forest Resource Survey's lithographed type maps on 1/4-inch-to-the-mile scale as a basis. On this map the following four factors were combined by means of cross-hatching, with light to heavy lines indicating the relative hazard of each factor:

(1) Forest type. Running from low hazard in the upper slope mixture with fir to high hazard in the fringe type where ponderosa pine is mixed with juniper.

(2) Site quality. As site quality drops, hazard is considered as increasing. (Sites II and III, low hazard; Site IV, medium; and Sites V and VI, high hazard.)

(3) Elevation. Stands were rated according to elevation, with low hazard at high elevation and high hazard at the lower edge of the pine belt.

(4) Volume per acre. Since volume per acre usually expresses the growth capacity of the site and whether or not it is favorable to pine growth, hazard was rated high in stands of low volume and low in stands of heavy volume.

The combination of these four factors on the overlay map served to indicate in what portions of the area all factors combined to make for low or high hazard, and what portions were indeterminate in character. This map might be considered as the theoretical picture of hazard conditions on the basis of the above assumptions.

On the second overlay map, prepared on the same scale as the first, was compiled the consolidated information from three years of beetle surveys in which snag counts were made on strips and plots and the entire area mapped as to intensity of beetle infestation. This map showed what beetle damage had actually occurred in different parts of the Klamath Subregion.

On putting these two overlay maps together, the agreement between the distribution of hazardous stand conditions and the actual beetle damage which had taken place during the last two decades was very striking. This made possible the preparation of a third overlay combining and interpreting these conditions to give an indication of future hazard.

Pine-Beetle Hazard Map. The pine-beetle hazard map, attached to this report and prepared in the manner described above, shows in a relative way where losses may be expected to occur during the next 10 to 20 years. How much loss will occur is, of course, dependent upon climatic conditions and beetle population to a large extent. But if losses do occur, they can be expected to hit the more hazardous areas harder than those of low hazard. Any prediction as to the amount and distribution of future losses necessarily must be based upon certain assumptions. The assumptions in the present case were as follows:

(1) For the next 10 years, the bark-beetle hazard to ponderosa pine stands will not be radically different from that prevailing during the past decade, except that

(2) As stands become badly depleted through repeated beetle attacks, there will be a gradual shift of losses into stands at higher elevations and of lower hazard rating where an abundance of overmature, highly susceptible trees may still be found.

(3) Stands which have been badly depleted and now show improved growth rate of the surviving stand and a recent reduction in loss rate can be given a lower hazard rating because they no longer contain sufficient volume of susceptible host material to support an epidemic. In extreme cases, such stands fall in the same category as cut-over or badly fire-killed areas. The probable amount of loss, while dependent upon beetle population and climatic conditions, can be assumed as approximating that for the past two decades in stands of similar composition and risk. This means that since the highest risk areas have been badly depleted of susceptible trees, future losses in remaining stands will proceed at a somewhat lower rate.

On the basis of these assumptions, the basic data of stand conditions and past losses were modified to show five degrees of future hazard, i.e., very low, low, medium, high, and very high. These five divisions were defined as follows:

(1) Very low hazard. Cut-over, burned, or badly bug-killed areas or young stands where appreciable net growth can be expected.

(2) Low hazard. Thrifty mature stands where losses and growth are approximately in balance. Probable gross loss in a 10-year period not exceeding 7 percent of the volume of the stand.

(3) Medium condition. Mature to overmature stands where losses exceed growth by a small margin, depleting mature stand over a natural rotation of about 300 years. Probable gross loss varying between 8 and 15 percent of the stand in a 10-year period.

(4) High hazard. Overmature stands where losses are approximately double the growth rate. Probable gross loss between 15 and 20 percent of the volume of the stand in 10 years.

(5) Very high hazard. Overmature, decadent stands where losses are more than double the growth rate and rapidly depleting the reserve. Probable gross loss exceeding 20 percent of the volume in 10 years.

The Beetle Hazard of the Larger Timber Properties.

While it might be desirable to have a more detailed map of beetle hazard, the greatest value of a hazard map is in the broader aspects of forest management and planning timber cutting operations in which the differential of hazard between small areas is of little significance. The general picture for the larger timber holdings, as indicated on the attached hazard map, is as follows:

High hazard areas of federally-owned timber on the Fremont National Forest are widely scattered and of small size. Probably the largest area of high risk is to be found on the slopes south and west of Silver Lake. Other areas are found around Bly and on the lower slopes of the Chewaucan Basin. The Warner Mountain Area is of exceptionally low hazard, as is also the area west of Bald Mountain. The Dog Lake Area is of only moderate risk, with some high risk in the western portions.

The highest risk areas on the Klamath Indian Reservation are found adjacent to the Sycan River and on the lower slopes of the Sprague River Valley. Much of the latter has already been cut over, or so badly bug-killed as to have little timber left to support an insect epidemic. The lower slopes of Yamsay Mountain and the country west of the upper Williamson River are of high-to-moderate hazard. Cutting is proceeding eastward into these areas at a rapid rate.

Of the privately-owned timberlands, the largest holdings are those of the Weyerhaeuser Timber Company. Their lands of highest hazard are found north of Bly and in the area south and west of Silver Lake. Their holdings on the Chewaucan Basin are of low-to-moderate hazard, while the Bear Springs Area southwest of Bald Mountain is generally of moderate-to-low hazard. These considerations are being taken into account by the company in planning future logging operations.

Timber stands of the Rogue River National Forest east of Crater Lake are either cut over or of low-to-very low hazard, as are also the stands of the Deschutes National Forest southwest of Walker Mountain.

It is hoped that this preliminary analysis of beetle-hazard conditions in the Klamath Subregion will be of help to these and other timber owners in planning their cutting operations, so as to salvage a high proportion of high-risk timber before it is further depleted by beetle epidemics.

DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
FOREST INSECT INVESTIGATION

PINE BEETLE HAZARD ZONATION
KLAMATH SUBREGION

SCALE 1 INCH = 4 MILES

- VERY LOW HAZARD
  CUTOVER, BURNED OR BADLY BUG-KILLED AREAS
- LOW HAZARD
  PROBABLE LOSS FROM 0 TO 7 PERCENT IN 10 YEARS
- MODERATE HAZARD
  PROBABLE LOSS FROM 8 TO 15 PERCENT IN 10 YEARS
- HIGH HAZARD
  PROBABLE LOSS FROM 15 TO 20 PERCENT IN 10 YEARS
- VERY HIGH HAZARD
  PROBABLE LOSS 20 PERCENT AND OVER IN 10 YEARS
- NON-TIMBERED AREAS
- NATIONAL FOREST BOUNDARY

FOREST INSECT LABORATORY,
PORTLAND, OREGON.

APRIL 15, 1939.

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R.18E. R.19E. R.20E. R.21E. R.22E.
T.25S. T.26S. T.27S. T.28S. T.29S. T.30S. T.31S. T.32S. T.33S. T.34S. T.35S. T.36S. T.37S. T.38S. T.39S. T.40S. T.41S.
R.9E. R.10E. R.10E. R.11½E. R.11½E. R.11E. R.11E. R.12E. R.12E. R.13E. R.13E. R.14E. R.14E. R.14½E. R.15E. R.16E. R.17E. R.18E. R.19E. R.20E. R.21E. R.22E.

Walker Mtn.
Bald Mtn.
PAULINA MARSH
SILVER LAKE
CRATER LAKE
Yamsey Mtn.
Klamath Marsh
Sycan Marsh
SUMMER LAKE
Williamson River
KLAMATH CO.
ROGUE RIVER N.F.
Agency L.
UPPER KLAMATH LAKE
KLAMATH CO. LAKE CO.
LAKE ABERT
Gearhart Mtn.
Sprague River
BLY
KLAMATH FALLS
Lost River
Gerber Res.
Drews Res.
LAKEVIEW
Klamath River
LOWER KLAMATH LAKE
Willow Valley Res.
Goose Lake
GOOSE LAKE
Crane Mtn.
KLAMATH CO.
OREGON
CALIFORNIA